MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E INOVAÇÃO

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CBPF Centro Brasileiro de Pesquisas Físicas
UNIDADE DE PESQUISA DO MCTI

UNITED NATIONS Office for Outer Space Affairs

Open Universe Initiative

A Capacity Building Initiative

Ulisses Barres de Almeida, CBPF & CLAF

With thanks to Paolo Giommi

Astro-COLIBRI Workshop - Institute Pascal - 20 NOV 2023

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CONTEXT

Space accessibility is one of the four pillars (others being space economy, space society and space diplomacy) supporting a Space 2030 Agenda, as established after UNISPACE+50.

- The Agenda envisions strategies and activities to strengthen the contribution of the space sector to the achievement of global targets, such as the SDGs.

- In particular, **space accessibility** responds to the underlining fundamental goal of sharing the benefits of space exploration amongst all nations.

- Reduction of inequality of opportunities in the growing and diversifying space sector, and enhancement of international cooperation in space, are at the basis of efforts to build a peaceful future of outer space.

DATA AS AN ENTRY DOOR TO SPACE

Data is specially relevant for space accessibility, and the distribution of the benefits of space exploration today.

Among the different avenues for space accessibility, data stands out as

- the most sustainable entry point,
- providing a cheap and secure starting level,
- based on education and capacity building

DATA AS AN ENTRY DOOR TO SPACE

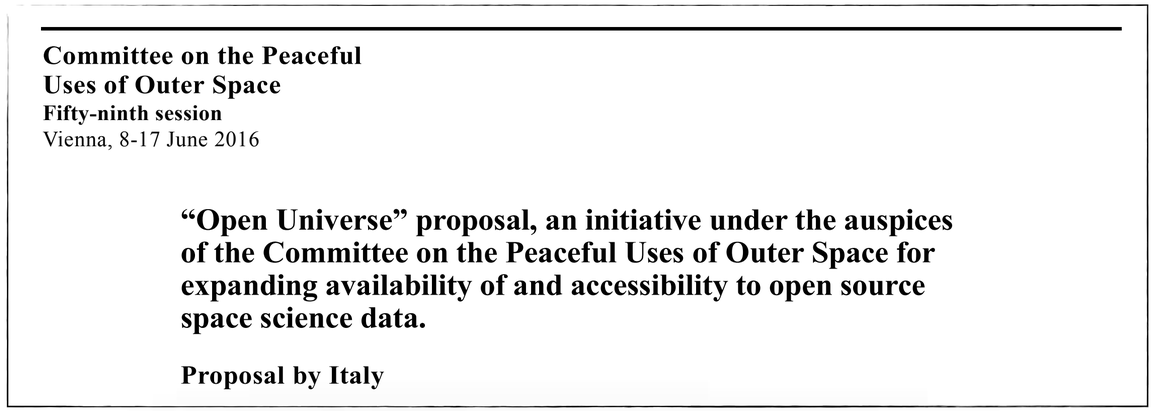
Data is specially relevant for space accessibility, and the distribution of the benefits of space exploration today.

It also offers a

- **cost-effective avenue for international co-operation for development,**
- **whereby local groups and new players can be quickly welcomed into the global arena,**
- **and impactful “south-south” co-operation can quickly be initiated.**

ORIGINS OF THE INITIATIVE

Original Open Universe Proposal at 59th COPUOS:
A/AC.105/2016/CRP6



Committee on the Peaceful Uses of Outer Space
Fifty-ninth session
Vienna, 8-17 June 2016

"Open Universe" proposal, an initiative under the auspices of the Committee on the Peaceful Uses of Outer Space for expanding availability of and accessibility to open source space science data.

Proposal by Italy

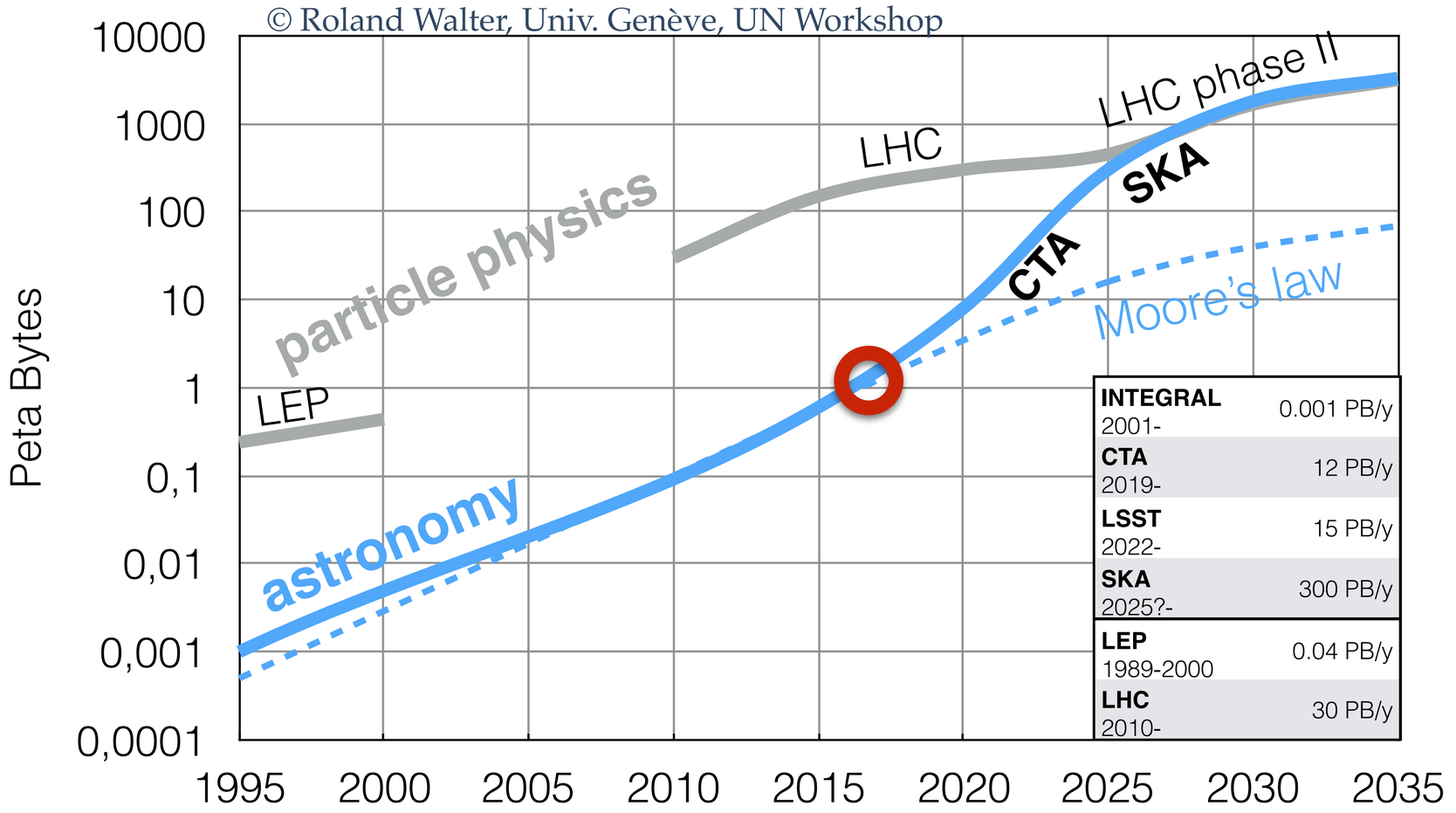
"Open Universe" was originally proposed by Italy as an initiative under the auspices of COPUOS, during the preparations for UNISPACE+50.

- **Main goal is** to dramatically expand the availability and access to space science data, responding to the growing demands of transparency on the use of public resources and of the societal returns of science.

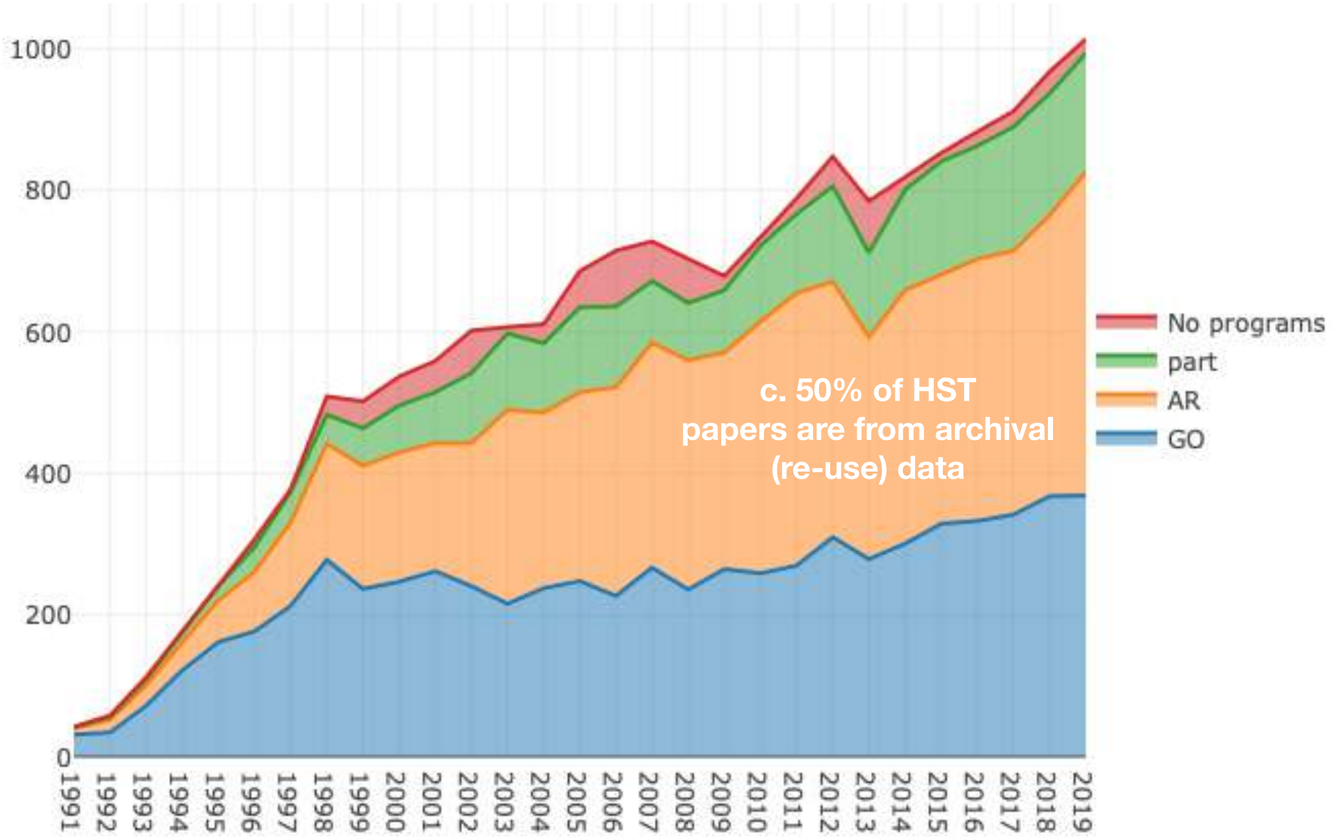
- **Motivated by** (i) from one side, the evidence of the increased rate of production of scientific data in all fields, including space science, and the responsibility to convert such data into effective knowledge; (ii) on the current context in which technological barriers to data sharing and access have been dramatically reduced, opening up new opportunities for knowledge dissemination and inclusion.

PREMISES

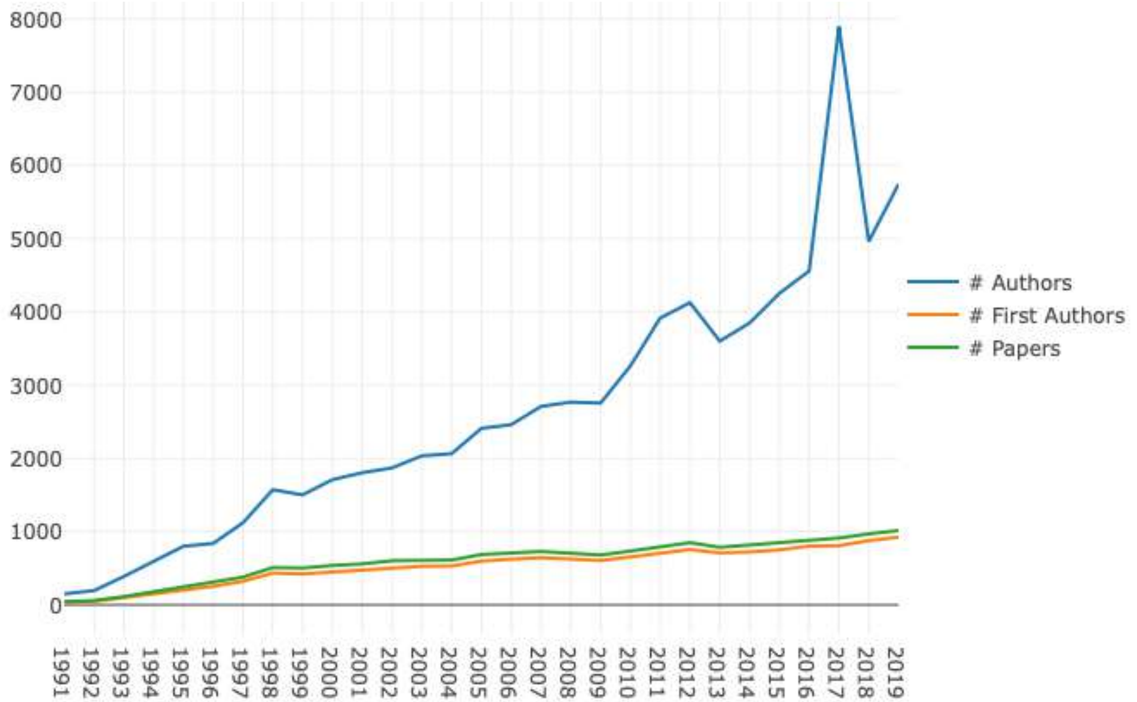
I - Dramatic increase in the volume of data produced in astronomy and space sciences



Space Telescope Science Institute Archives



Unique authors chart

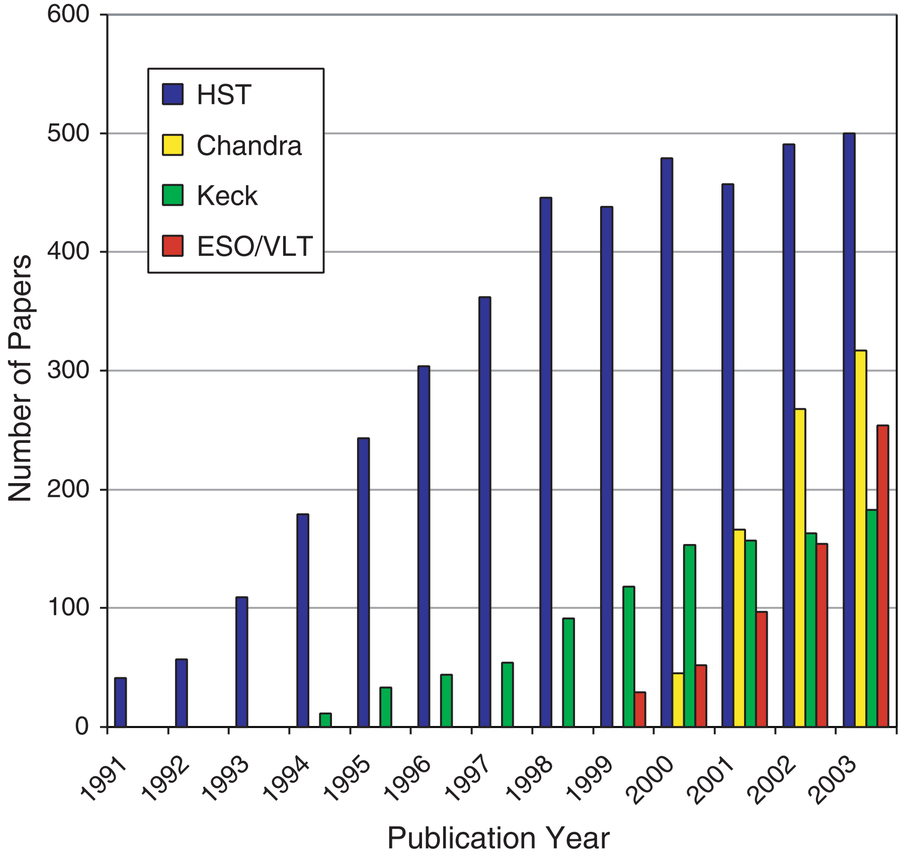


HST has one of the best-serviced data archives amongst astronomical observatories, which resulted in an increase of 2x the number of science publications and number of papers and unique authors.

Open Science

The example of the Hubble Space Telescope

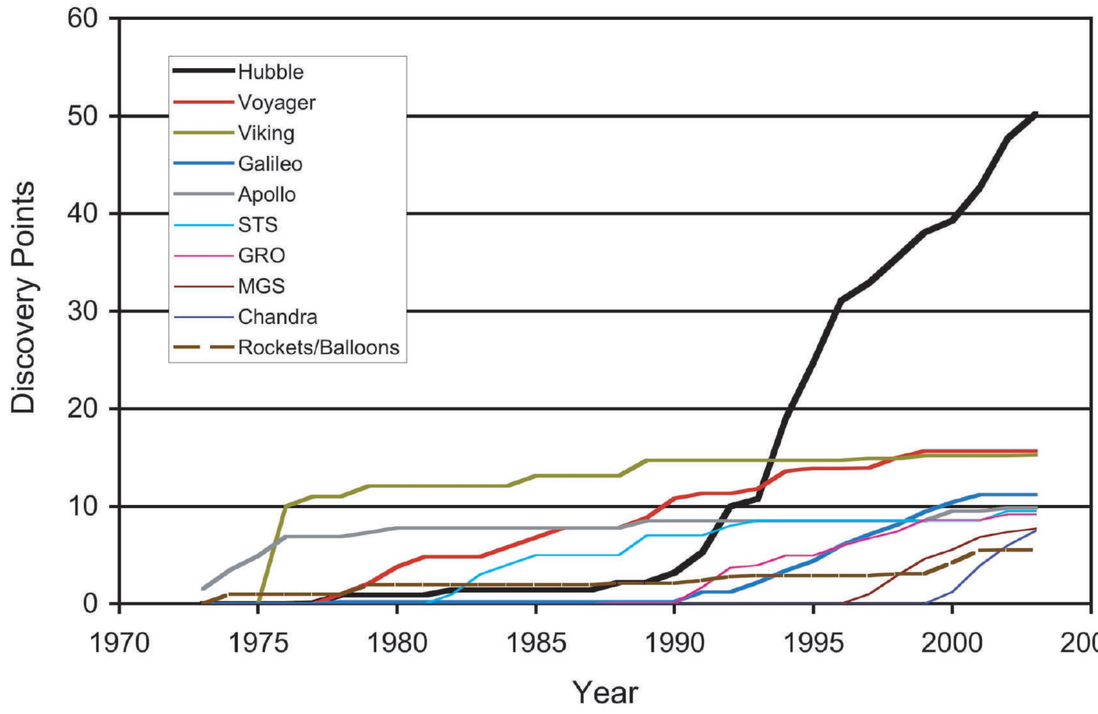
US National Academy of Sciences
Publication output for major astronomical facilities



Science with Hubble:

— age of the Universe
— Universe expansion rate (Nobel '11)
— Supermassive Black Holes (Nobel '20)
— Distribution of matter in the Universe (dark matter)

Discovery in the media

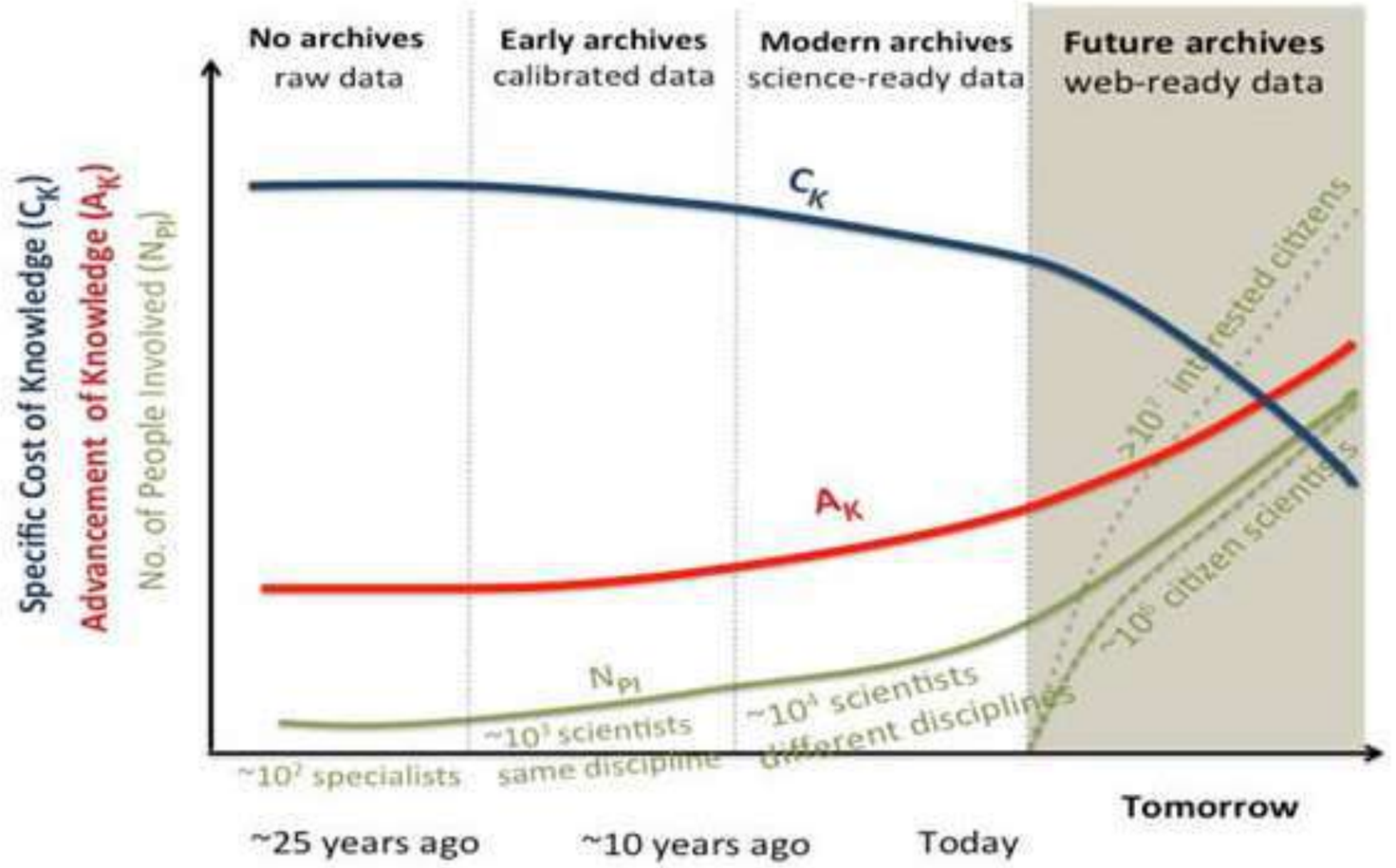


Open Science

The example of the Hubble Space Telescope

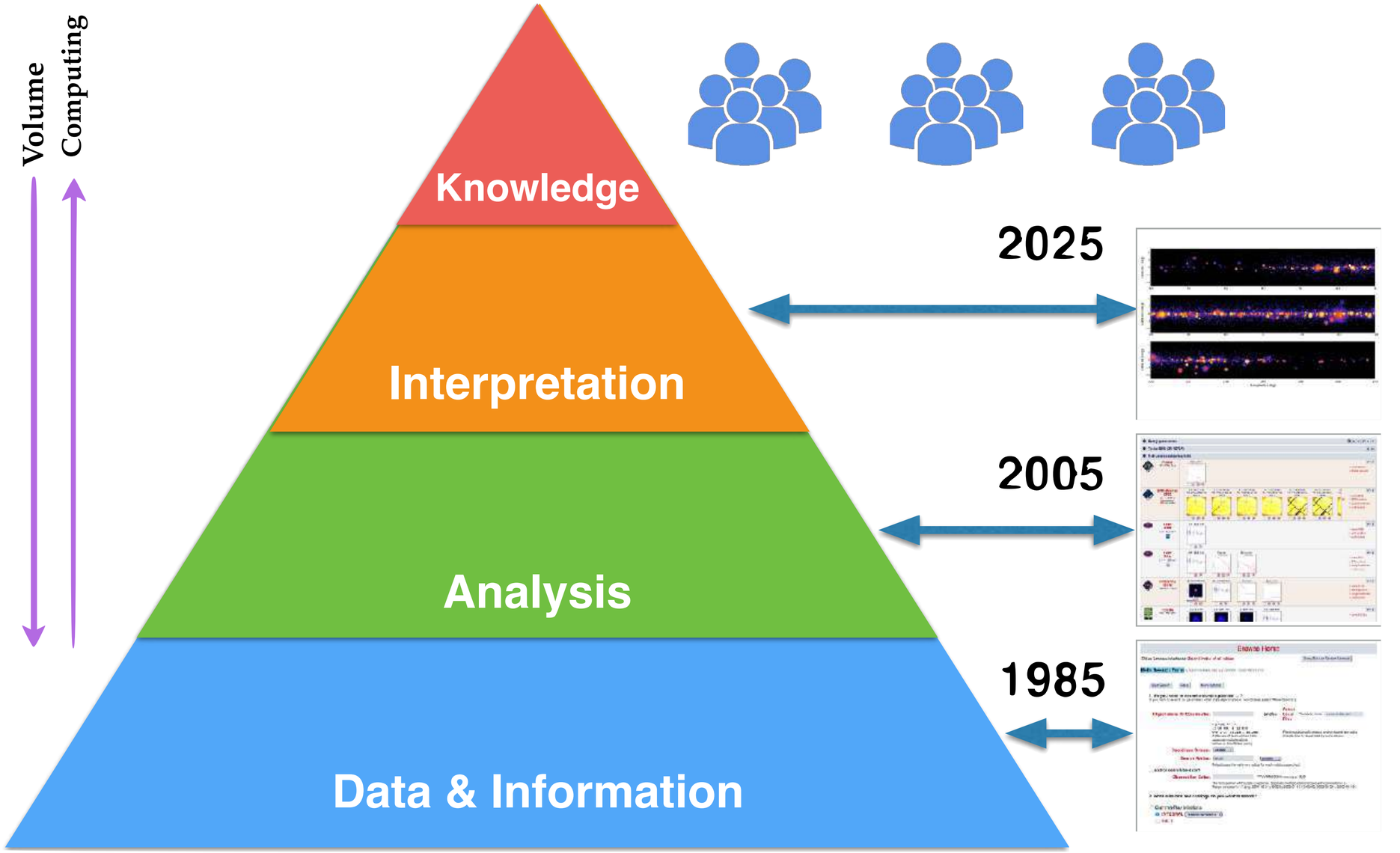
PREMISES

II - Evolution of information technology opens new opportunities for data sharing, accessibility, and utilisation.



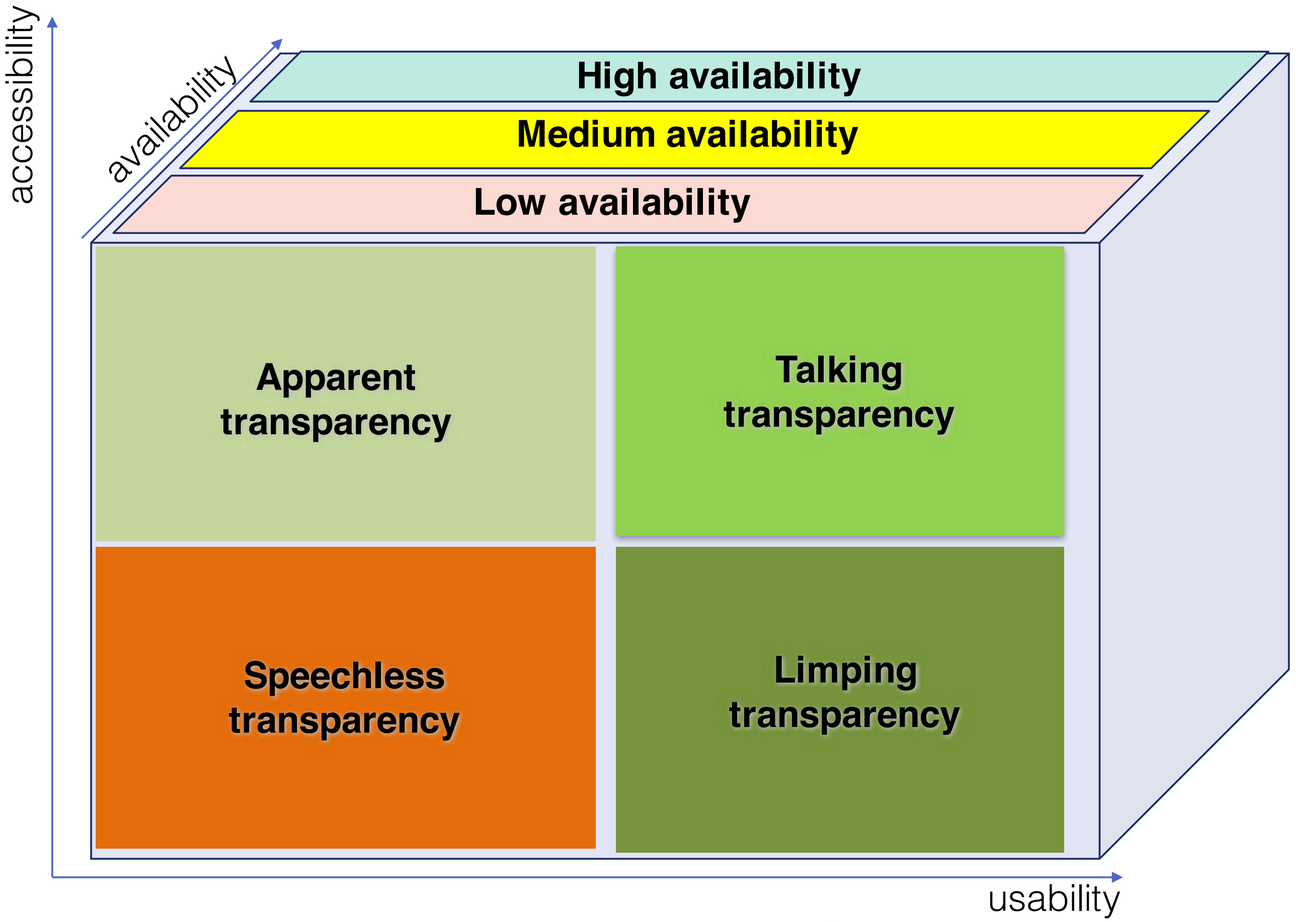
From the original COPUOS proposal by Italy

DEMOCRATISING KNOWLEDGE



Transparency Matrix

Massimo De Angelis, ASI



Mute Transparency: Open data have no transparency;

Apparent Transparency: Open data have low usability level, even if accessibility is high;

Partial Transparency: Open data have a high usability level, even if accessibility is low;

Communicative Transparency: Open data have good quality level and accessibility. At this stage effective transparency is reached.

“Sustainability” of open data for Development

The basic resources (e.g. IVOA) are already in place.

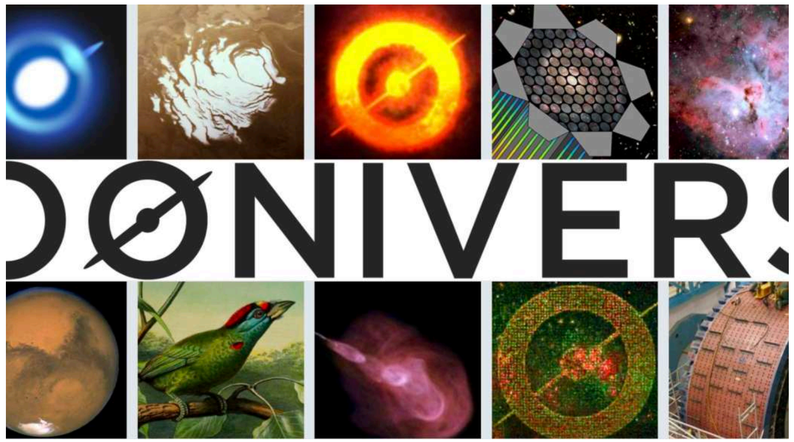
With some small-ish effort the entry barrier can be further lower to welcome a growing and diverse number of actors.

Developmental and societal impact is the best argument for justifying additional expenditure to maintain services by e.g. large missions.

Increased cooperation reduces costs in the long-term.

Knowledge-based society?

Examples from Citizen-Science



Citizen-science are co-authors in MNRAS article baseado on a project from zooniverse.org

Monthly Notices of the ROYAL ASTRONOMICAL SOCIETY

MNRAS **494,** 750–763 (2020) doi:10.1093/mnras/staa138
Advance Access publication 2020 January 23

Planet Hunters TESS I: TOI 813, a subgiant hosting a transiting Saturn-sized planet on an 84-day orbit

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ABSTRACT

We report on the discovery and validation of TOI 813 b (*TIC 55525572 b*), a transiting exoplanet identified by citizen scientists in data from NASA's Transiting Exoplanet Survey Satellite (*TESS*) and the first planet discovered by the Planet Hunters *TESS* project. The host star is a bright ($V = 10.3$ mag) subgiant ($R_\star = 1.94\,R_\odot$, $M_\star = 1.32\,M_\odot$). It was observed almost continuously by *TESS* during its first year of operations, during which time four individual transit events were detected. The candidate passed all the standard light curve-based vetting checks, and ground-based follow-up spectroscopy and speckle imaging enabled us to place an upper limit of $2\,M_{\rm Jup}$ (99 per cent confidence) on the mass of the companion, and to statistically validate its planetary nature. Detailed modelling of the transits yields a period of $83.8911^{+0.0027}_{-0.0031}$ d, a planet radius of $6.71 \pm 0.38\,R_\oplus$ and a semimajor axis of $0.423^{+0.031}_{-0.037}$ AU. The planet's orbital period combined with the evolved nature of the host star places this object in a relatively underexplored region of parameter space. We estimate that TOI 813 b induces a reflex motion in its host star with a semi-amplitude of $\sim 6\,{\rm m\,s^{-1}}$, making this a promising system to measure the mass of a relatively long-period transiting planet.

Key words: methods: statistical – planets and satellites: detection – stars: fundamental parameters – stars: individual (TIC-55525572 – TOI 813).

Paper at Research Notes of AAS totally lead and authored only by citizen-scientists.

RNAAS RESEARCH NOTES OF THE AAS

Single Transits and Eclipses Observed by *K2*

Daryll M. LaCourse and Thomas Lee Jacobs

Research Notes of the AAS, Volume 2, Number 1

References Article data

1 INTRODUCTION

The Transiting Exoplanet Survey Satellite (*TESS*; Ricker et al. 2015) is the first nearly all-sky space-based transit search mission. Over the course of its two-year nominal mission, *TESS* will observe hemisphere) that extend from the ecliptic pole to near the ecliptic plane. Targets located at low ecliptic latitudes (around 63 per cent of the sky) will be monitored for ≈27.4 continuous days, while a total of ∼2 per cent of the sky at the ecliptic poles will be observed continuously for ∼356 d. This observational strategy means that (≲20 d) low for a 2018; 9). y more obability

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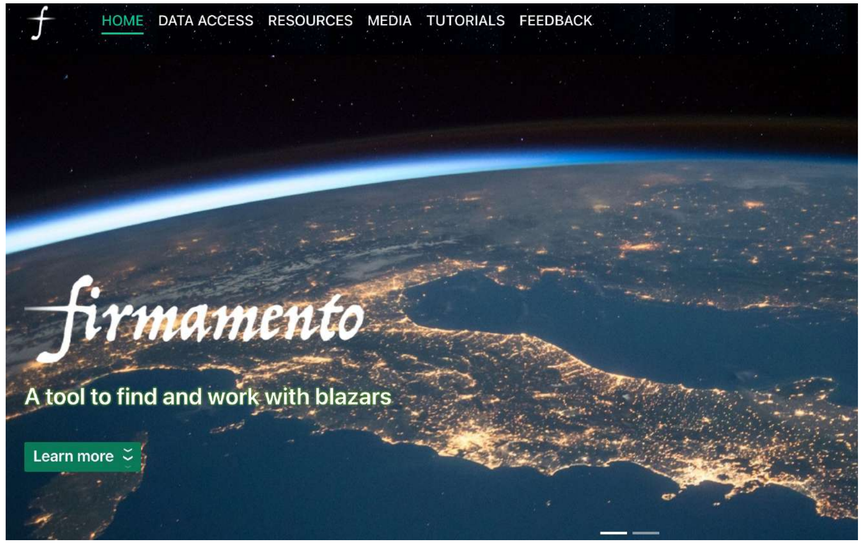
† Citizen Scientist, Zooniverse.

Knowledge-based society?

Examples from Citizen-Science



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12th Cosmic Ray International Seminar - CRIS 2022 IOP Publishing
Journal of Physics: Conference Series **2429** (2023) 012045 doi:10.1088/1742-6596/2429/1/012045

A catalog of new Blazar candidates with Open Universe by High School students

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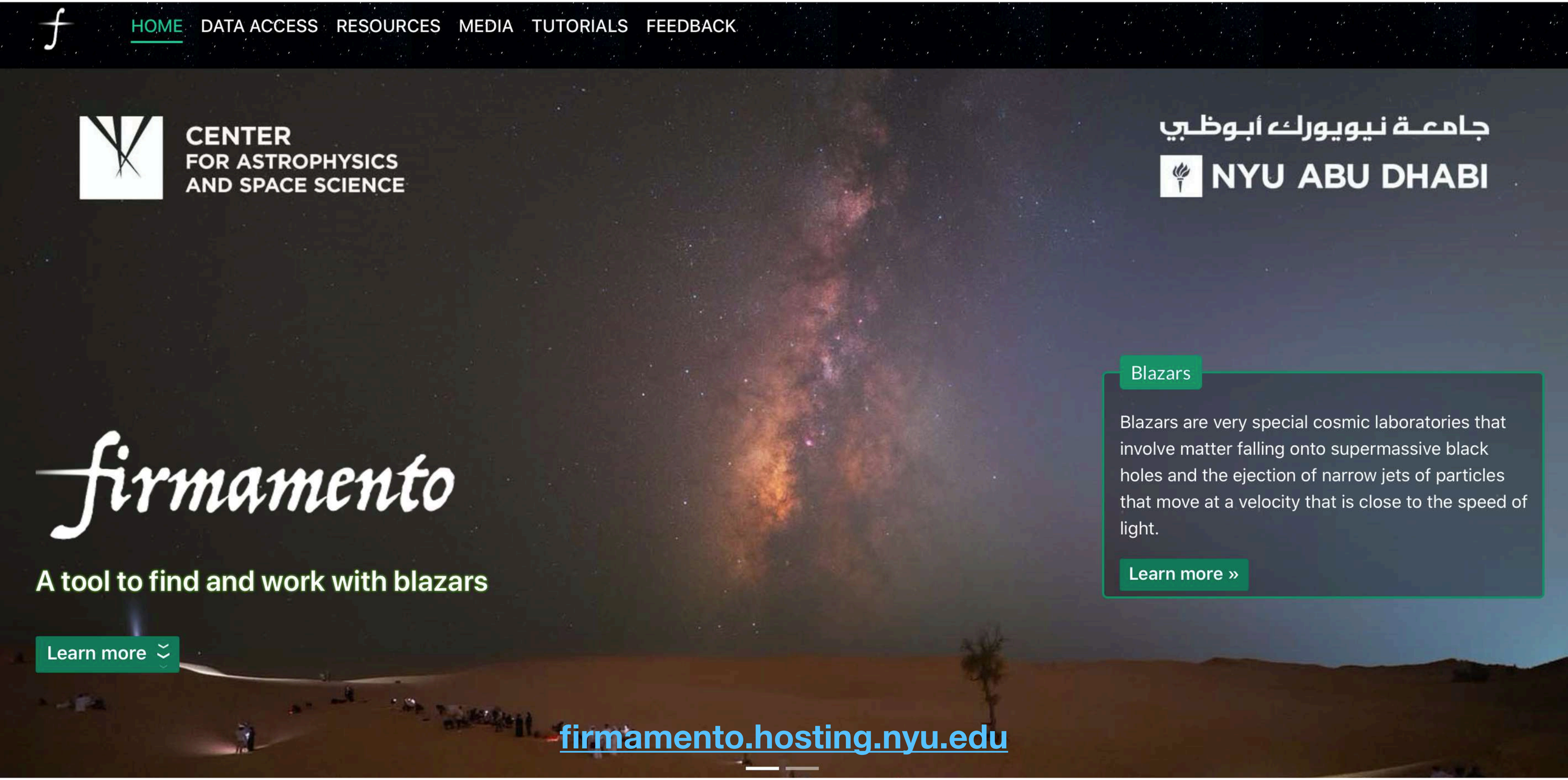
September 2022

Abstract. Blazars are active galactic nuclei whose ultra-relativistic jets are co-aligned with the observer direction. They emit throughout the whole e.m. spectrum, from radio waves to VHE gamma rays. Not all blazars are discovered. In this work, we propose a catalog of new highly probable candidates based on the association of HE gamma ray emission and radio, X-ray an optical signatures. The relevance of this work is also that it was performed by four high school students from the Liceo Ugo Morin in Venice, Italy using the open-source platform Open Universe in collaboration with the University of Padova. The framework of the activity is the Italian MIUR PCTO programme. The success of this citizen-science experience and results are hereafter reported and discussed.

Fermi ID	Ra	Dec	LSSUM ID	Ra	Dec	z	ν_{peak}
4FGL J0000.7+2530	0.188	25.515	LSSUM J0001.2+2546	0.116	25.468	0.49	16.60 ±.50
4FGL J0026.1-0732	6.540	-7.543	LSSUM J0006.9-0752	6.549	-7.521	-	16.90 ±.40
4FGL J0045.8-1324	11.472	-13.403	LSSUM J0115.1-1341	11.513	-13.411	-	15.60 ±.60
4FGL J0055.7+4507	13.940	45.124	LSSUM J0139.2+4512	13.929	45.117	-	15.70 ±.40
4FGL J0152.9-1109	28.237	-11.162	LSSUM J0283.0-1111	28.305	-11.107	-	16.40 ±.40
4FGL J0154.6+0051	28.661	0.862	LSSUM J0287.5+0831	28.751	0.831	-	15.30 ±.70
4FGL J0159.8-2234	29.951	-22.576	LSSUM J0299.4-2255	29.945	-22.548	-	16.10 ±.50
4FGL J0231.0+3505	37.775	35.100	LSSUM J0378.0+3508	37.801	35.079	-	17.20 ±.50
4FGL J0249.2+1652	42.303	16.882	LSSUM J0422.6+1688	42.262	16.883	-	16.30 ±.40
4FGL J0251.1-1830	42.784	-18.509	LSSUM J0427.9-1852	42.798	-18.520	-	15.70 ±.50
4FGL J0357.7-6808	59.440	-68.134	LSSUM J0593.8-6816	59.385	-68.159	-	15.90 ±.40
4FGL J0420.6-4802	65.173	-48.048	LSSUM J0651.6-4795	65.161	-47.951	-	16.40 ±.50
4FGL J0438.0-7329	69.524	-73.485	LSSUM J0696.5-7349	69.654	-73.489	-	15.50 ±.30
4FGL J0539.2-6333	85.055	6.917	LSSUM J0847.3-6354	84.733	-63.544	-	-
4FGL J0625.5+7029	96.392	70.497	LSSUM J0963.9+7049	96.395	70.495	-	16.30 ±.70
4FGL J0641.4+3349	100.356	33.820	LSSUM J1004.2+3382	100.425	33.824	-	14.20 ±.60
4FGL J0751.2-0029	117.812	-0.488	LSSUM J1178.3-0046	117.830	-0.464	-	16.00 ±.50
4FGL J0800.9+0733	120.226	7.551	LSSUM J1202.4+0754	120.236	7.543	-	-
4FGL J0815.5+6554	123.880	65.900	LSSUM J1239.1+6583	123.914	65.834	-	16.10 ±.40
4FGL J0838.5+4013	129.629	40.224	LSSUM J1297.6+4026	129.763	40.263	0.19	15.60 ±.50
4FGL J0903.5+4057	135.899	40.962	LSSUM J1358.1+4093	135.811	40.934	0.19	16.20 ±.40
4FGL J0914.5+6845	138.647	68.751	LSSUM J1386.2+6875	138.624	68.752	-	15.90 ±.50
4FGL J0944.6+5729	146.090	-9.192	LSSUM J1461.3+5759	146.134	57.593	0.72	16.10 ±.40
4FGL J1047.2+6740	161.820	67.674	LSSUM J1617.7+6763	161.774	67.633	-	16.30 ±.50
4FGL J1118.1+5857	169.542	58.965	LSSUM J1692.9+5898	169.286	58.988	0.08	16.00 ±.70
4FGL J1146.0-0638	176.502	-6.638	LSSUM J114601-063855	176.504	-6.649	-	15.88 ±.03
4FGL J1155.2-1111	178.820	-11.189	LSSUM J115515-111123	178.812	-11.190	-	16.60 ±.50
4FGL J1158.8-1430	179.709	-14.501	LSSUM J115817-143057	179.570	-14.516	-	15.00 ±.50
4FGL J1403.7+2429	210.936	24.495	LSSUM J140350+243305	210.958	24.549	0.34	16.65 ±.49
4FGL J1409.8+7921	212.464	79.351	LSSUM J141046+792414	212.693	79.403	-	12.72 ±.39
4FGL J1441.4-1934	220.350	-19.578	LSSUM J144128-193552	220.366	-19.599	-	15.84 ±.91
4FGL J1452.0-4148	223.017	-41.804	LSSUM J145225-414948	223.101	-41.830	-	15.19 ±.56
4FGL J1519.7+6727	229.943	67.458	LSSUM J152000+673224	229.997	67.540	-	14.47 ±.68
4FGL J1544.9+3218	236.239	32.304	LSSUM J154433+322149	236.138	32.364	0.51	15.49 ±.97
4FGL J1554.2+2008	238.553	20.148	LSSUM J155424+201125	238.601	20.190	0.22	15.52 ±.73
4FGL J1626.5+6257	246.644	62.959	LSSUM J162646+630049	246.692	63.014	-	16.78 ±.20
4FGL J1628.2+4642	247.063	46.715	LSSUM J162755+464249	246.981	46.713	0.21	16.23 ±.43
4FGL J1658.5+4315	254.646	43.254	LSSUM J165832+431615	254.631	43.273	-	15.76 ±.24
4FGL J1706.4+6428	256.606	64.475	LSSUM J170623+642725	256.597	64.457	-	15.64 ±.51
4FGL J1727.1+5955	261.776	59.926	LSSUM J172640+595549	261.669	59.931	0.78	16.78 ±.42
4FGLJ1923.0-4746	290.752	-47.769	LSSUM J2907.6-4775	290.768	-47.751	-	16.90 ±.50
4FGLJ1928.5+5339	292.139	53.653	LSSUM J2921.4+5365	292.141	53.652	-	17.40 ±.40
4FGLJ2012.1-5234	303.039	-52.570	LSSUM J3030.5-5254	303.058	-52.548	-	16.20 ±.40
4FGLJ2020.7-4536	305.198	-45.614	LSSUM J3050.9-4549	305.094	-45.491	-	16.70 ±.50
4FGLJ2022.3+0413	305.598	4.222	LSSUM J3056.0+4209	305.604	4.210	-	17.00 ±.50
4FGLJ2028.8-0010	307.215	-0.171	LSSUM J3072.0-0143	307.209	-0.144	-	16.30 ±.50
4FGLJ2030.3-5038	307.590	-50.634	LSSUM J3075.9-5057	307.599	-50.570	-	16.60 ±.40
4FGLJ2038.7-3655	309.686	-36.925	LSSUM J3096.6-36.90	309.668	-36.908	-	16.30 ±.60
4FGLJ2142.5-2029	325.642	-20.497	LSSUM J3256.6-2047	325.667	-20.473	-	-
4FGLJ2144.8-1600	326.216	-16.010	LSSUM J3261.6-1599	326.163	-15.993	-	16.40 ±.50
4FGLJ2201.0-3228	330.257	-32.477	LSSUM J3306.0-32.17	330.610	-32.171	-	-
4FGLJ2207.1+2222	331.791	22.374	LSSUM J3317.6+2237	331.767	22.376	0.56	15.90 ±.50
4FGLJ2217.0-6727	334.255	-67.453	LSSUM J3342.4-6746	334.247	-67.468	-	-
4FGLJ2237.2-6726	339.304	-67.437	LSSUM J3392.8-6743	339.289	-67.439	-	-
4FGLJ2237.8+2430	339.458	24.511	LSSUM J3394.0+2454	339.410	24.548	0.50	-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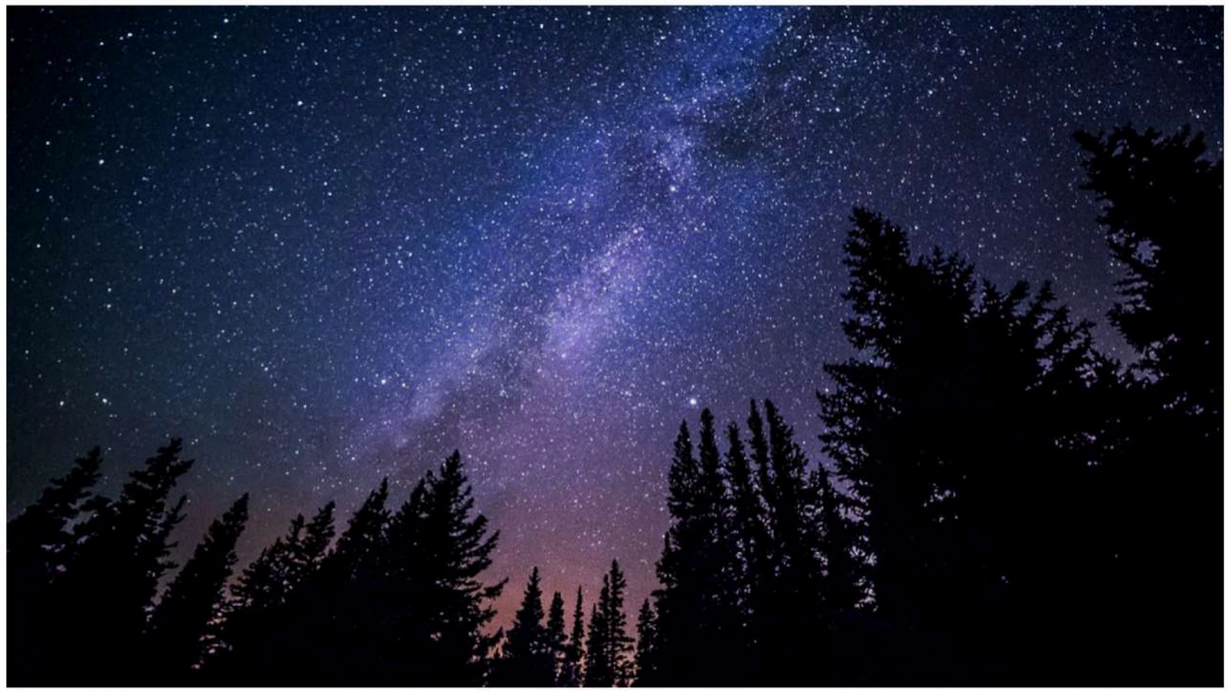
Open Universe

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Space science data for everyone

Open Universe documents

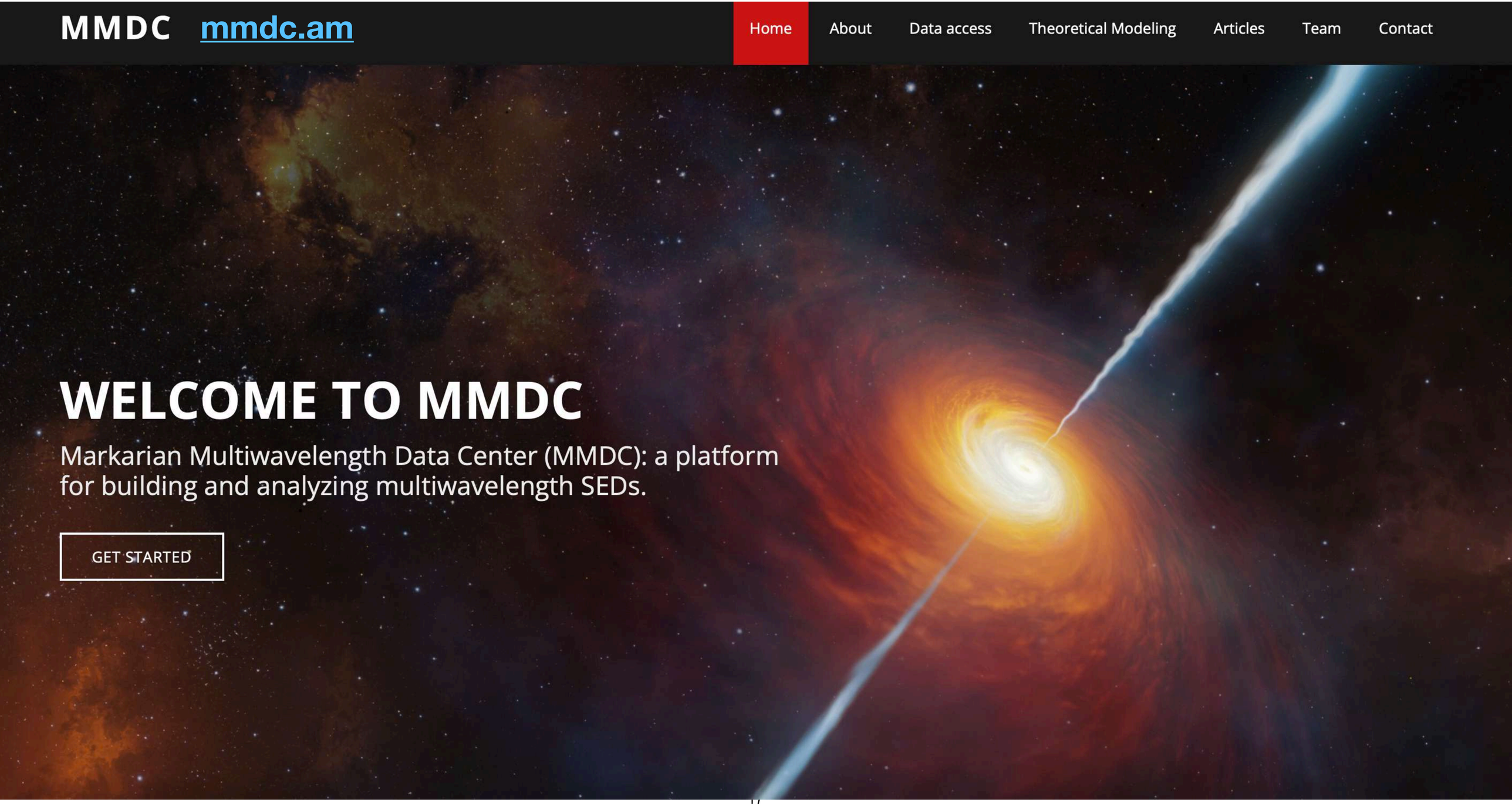
- Open Universe paper
- Original proposal A/AC./105/2016/CRP.6
- Report on the Open Universe Expert Meeting
- Report on the Open Universe workshop

Open Universe Technical presentations

- June 2016 - COPUOS, 59th session
- June 2017 - COPUOS, 60th session
- February 2018 - COPUOS-STSC, 55th session
- November 2018 - United Nations/Germany High Level Forum
- February 2019 - COPUOS-STSC, 56th session

Open Universe Workshops

- Open Universe Expert Meeting, 11-12 April 2017, ASI-HQ, Rome, Italy
- Open Universe Workshop, Vienna 20-22 November 2017
- Open Universe international doctoral school, Nice
- Open Universe Workshop @ New York University Abu Dhabi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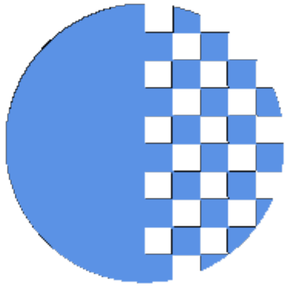
GET STARTED

PILLARS OF THE OPEN UNIVERSE INITIATIVE



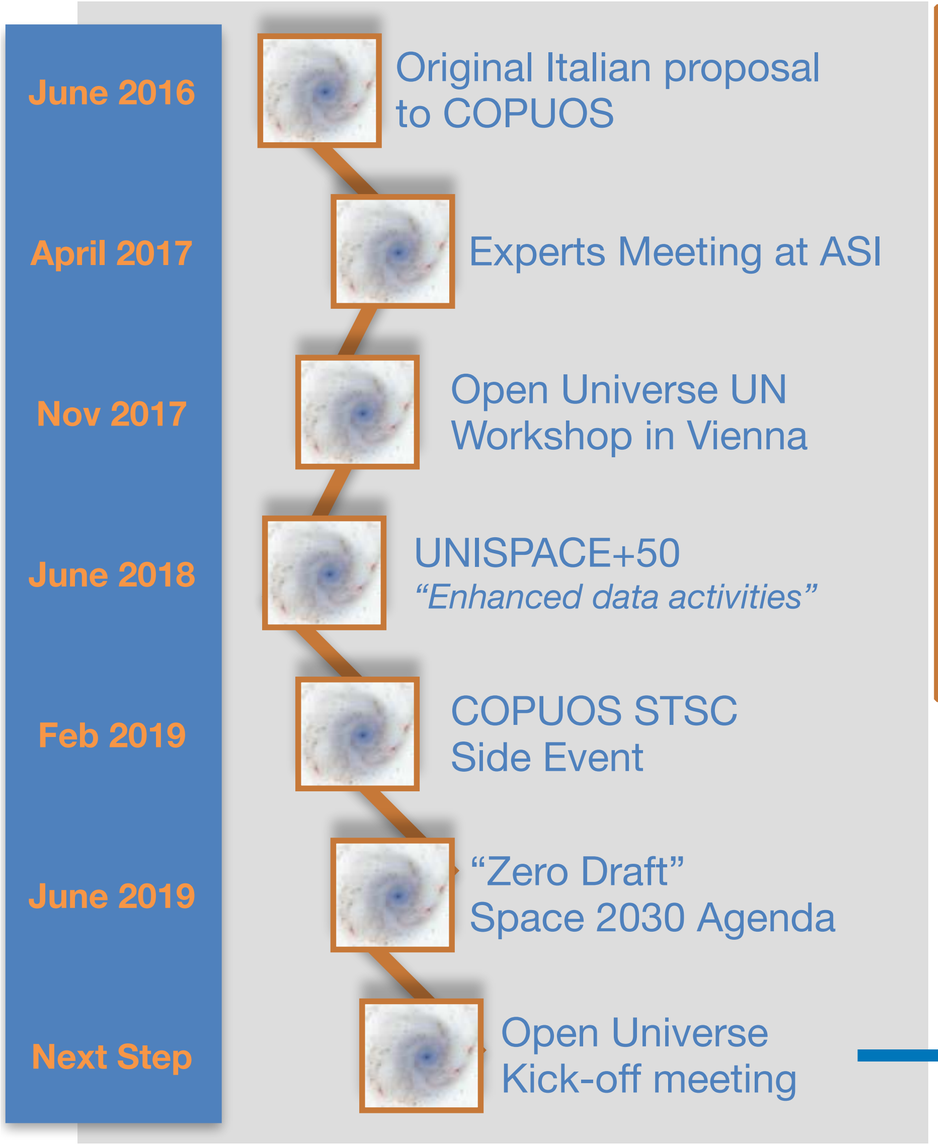
INCREASE TRANSPARENCY of already accessible resources: including promoting FAIR (Findable, Accessible, Interoperable, Reusable) guiding principles, promoting the adoption of widely-used standards, processing from raw data to web-ready products, enhanced data-mining and integration solutions, interfacing and facilitating cooperation between data providers and data centres and archives…

RESURFACE DATA and other hidden or otherwise hardly accessible resources: by identifying inaccessible data and working with national and regional entities to solve the challenges to make them public, including legacy data, as well as bringing new main players and actors in the international space science arena into the Initiative and in contact with other public data access solutions.

BROADEN THE USER-BASE of astronomy and space science data: to include as well the rapidly growing community of citizen scientists, by providing the necessary tools to use astronomy and space science data for a range of target groups, including educators and students, planetariums, amateur scientists or other potential end-users; and by promoting STEM education, particularly among women and youth in developing countries.

Outcomes from the UN Open Universe Workshop, 2017

STEPS TOWARDS THE OPEN UNIVERSE INITIATIVE



Experts Meeting @ ASI, Feb 2017
http://www.openuniverse.asi.it/documents/ou_documents.php

United Nations Workshop, Nov 2017
http://www.unoosa.org/oosa/en/ourwork/psa/schedule/2017/workshop_italy_openuniverse.html

UNOOSA Report on Open Universe:
http://www.unoosa.org/oosa/oosadoc/data/documents/2018/aac.105/aac.1051175_0.html

"Zero Draft" 2030 Agenda:
http://www.unoosa.org/oosa/oosadoc/data/documents/2019/aac.105c.22019crp/aac.105c.22019crp.24_0.html

All necessary instruments are in place from the side of Brazil and UNOOSA to move ahead with implementation

What is next for Open Universe?

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- **Open Universe is the right concept for a UN-based Capacity Building Initiative**

  It is a focus point for development actions, connecting various actors around the world.

- **There is an ever-growing set of infrastructure and institutional support to sustain capacity building activity.**

  The next step is to connect the demand to providers, in a sustainable capacity building initiative.

What is next for Open Universe?

A first capacity building event is being planned for next year, in hybrid format, based in Rio.

Partnership with various data / tool providers will be called to join the training and help shape up the event.

The event will be done under the auspices of UNOOSA and co-funded by the BR Ministry of Science, and open to the inputs and participation of all UN Member States and

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